CVM UNIVERSITY
Aegis: Charutar Vidya Mandal (Estd.1945)

FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **Master of Technology (Food Technology)**

Semester: **1**

Course Code: **202380101**

Course Title: **Advances in Drying and Dehydration**

Course Group: **Core Course I**

Course Objectives:

1. To understand and apply fundamentals of advanced drying techniques for complex situations for different types of food products
2. To learn recent developments and constructional intricacies in the field of food drying

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	0	2	4	50/20	50/20	25/10	25/10	150/60

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Conten	Hours
1	Fundamental concepts in drying: Theories of drying, drying rate characteristic curve, heat and mass transfer mechanisms in drying, models for prediction of sorption isotherms.	5
2	Advances in drying technologies, classification and selection criteria-conventional versus novel technologies, recent trends in drying technology, Airless drying, drying in mobilized beds, vacuum jet drying, Refractance window drying. Dryer performance indices. Pulsed fluid bed drying: Principle and layout.	7
3	Dryer design: Design steps and calculations.	4
4	Superheated steam drying: Principle and modeling, applications.	2
5	Sonic drying: Principle and mechanism of sonic drying, drying kinetics.	3

6	Heat pump assisted drying: Fundamentals of heat pump dryers, heat and mass transfer mechanisms, optimum use of heat pump in drying systems, HP dryer	**4**
7	Contact sorption drying: Principle, mechanism and technology of contact sorption drying.	**5**
8	Spray drying, Freeze drying: Principle, process design calculations and	**5**
9	Hybrid drying technologies: microwave-convective drying, microwave vacuum drying, filter-mat drying, vibrated fluid bed dryer.	**4**

List of Practicals / Tutorials:

1	Determination of drying characteristics and study of kinetics
2	Prediction of moisture sorption isotherms
3	Determination of quality of dried food products
4	Study of freeze drying process and determination of drying constants
5	Evaluate performance of superheated steam drying process.
6	To model the sonic drying process
7	To study the mass and energy transfer process in spray drying
8	To model heat pump assisted drying system for foods
9	Refractance window drying of foods
10	Industrial visit to different food drying processing plants

Reference Books:

1	Handbook of Industrial Drying, Edited By Arun S. Mujumda, CRC Press, 2006
2	Advanced Drying Technologies, Kudra T & Mujumdar AS, CRC Press, 2009
3	Drying Technologies for Foods: Fundamentals and Applications, Prabhat K. Nema, Barjinder Pal Kaur, Arun
4	Dehydration of Foods, Barbosa-Canovas GV, Vega-Mercado HV, International Thomson publishing, 1996
5	Drying of Foods, Vegetables and Fruits (Volume 1), Sachin V. Jangam, Chung Lim Law and Arun S. Mujumdar.
6	Hand Book of Food Dehydration & Drying, by Eiri Board, Published by Engineers India Research Institute (2008)
7	Drying and Dehydration of Foods Paperback by Harry W. Von Loesecke, Delany Pres, 2012
8	Advances in food dehydration by Kudra, T. CRC Press, 2008

Supplementary learning Material:	
1	http://www.aces.uiuc.edu/vista/html_pubs/DRYING/dryfood.html
2	http://nchfp.uga.edu/how/dry.html
3	http://www.britannica.com/EBchecked/topic/172410/drying-process
4	http://science.utcc.ac.th/lecturer/muanmai/AITdownload/Ch5_moisture&drying.ppt

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Industrial/ Field visits
- Course Projects

Internal Evaluation:

The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks (%)						**R**: Remembering; **U**: Understanding; **A**: Application, **N**: Analyze; **E**: Evaluate; **C**: Create
R	**U**	**A**	**N**	**E**	**C**	
15	20	20	25	20	0	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightag
CO-1	Understand and apply advanced drying concepts for foods.	**25**
CO-2	Understand drying mechanism and develop functional design of dryers.	**25**
CO-3	Ability to construct and deploy specific dryers for applications.	**20**
CO-4	Understand novel and hybrid drying technology and applications.	**30**

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Curriculum Revision:	
Version:	2.0
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	-
Next Review on (Month-Year):	June-2025